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THE HALO SYMPTOMS IN GLAUCOMA.

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Halo is classed among the prodromata of glaucoma; it may occur later in the progress of primary simple glaucoma. Some subjects of glaucoma, more observant than others, mention it without suggestion from the physician. In many cases it is not noted, or little importance attached to it. A few attempts have been made to explain it. DeWecker thinks it "due to very slight alterations in the epithelial layer of the cornea, produced by temporary increase of pressure." Wolfe suggests that it "may be owing to dilatation of the pupil, to change in the lens, or to disturbance in the circulation." Neither disturbance of the circulation nor dilatation of the pupil, when they exist under other circumstances, seem to cause the phenomenon. Alterations in the epithelial layer of the cornea, and

change in the lens, are phrases of vague significance, the exact meaning of which may be only surmised, except that Dr. DeWecker qualifies his statement by the expression "is analogous to a similar phenomenon witnessed in most cases of conjunctival catarrh, where there is irregular desquamation of the epithelium.

In conjunctival catarrh the peculiarity is rather due to diffraction of rays of light by globules of secretion on the surface of the cornea, as it disappears when they are removed; moreover, cocaine, which disturbs the corneal epithelium, lessens conjunctival secretion, and dilates the pupil, does not seem to produce the halo. Let it be farther suggested that constant slight changes in the corneal epithelium are physiologically present without the phenomenon; therefore we must look for some other explanation.

Dobrowolski of St. Petersburg (*Archiv. of Ophthalmology*, Vol. XV, 1886, p. 267) assumes that the glaucoma halo "depends upon irritation of the retina and optic nerve by hyperæmia," in support of which he cites a personal experience while in a Russian bath. The rainbow rings became even more intense and distinct when he entered a *cooler* room. He continues, "for the last few months I have constantly seen these rings around the lamp light in the evening. There is no noticeable increase of tension, and the visual acuteness is 25/20. Tension of accommodation always rendered them (the rings) more distinct."

As the cause of glaucoma must be in action previous to increase of tension, or diminished acuteness of vision, as the halo is a prodrome, Dr. Dobrowolski's eyes must rest under suspicion of inherent tendency.

The halo is rarely constant, but appears and disappears, to recur again; and with increasing frequency as the disease develops.

At one time it may be a corona; at another, it appears in the shape of vari-colored *sparks* of light. This intermittence and change of form would indicate that the cause is not persistent; that, at times, it lacks force and distribution. Pressure *upon* the globe will produce a ring of colored light, or a

luminous spot, always opposite to the point of pressure. The halo may be present in glaucoma with seeming normal intra-ocular tension, and may be absent during increased tension; gradual, steady pressure will not produce sparks of light.

The cause of halo would seem to be not in the retina itself, but in the media anterior to it. Its variability suggests the aqueous humor, or some surface in contact with the aqueous humor, for it is in the serum of the blood that the chief deviation from the healthy standard is perceived; products of excretion which have not been eliminated (Garrod).

The laws of nature are undeviating; the law of gravitation, terrestrial and celestial, is the same; so with the law of light: The lunar halo is a familiar object, the cause of which does not exist in ourselves, nor in the moon, but in the intervening media whose character changes. The Descartes theory of the encircling lunar halo was accepted by Marriotte, Dr. Thomas Young, and Sir Isaac Newton, and remains to-day the unquestioned explanation. According to Descartes, it is owing to the reflection and refraction of rays of light by minute snow and ice crystals in the upper strata of air, and occurs in the presence of the cirrus, or ice-cloud. Professor Cleveland Abbe explains the arrangement of colors in a circle of 22° radius, the inner edge red, and the outer edge blue, to be "light polarized in direction of tangent to circumference; it is formed by light passing through the alternate faces of hexagonal ice-crystals in the direction of minimum deviation, through the base and sides of right prisms."

The prevailing arrangement of colors in the halo of glaucoma is red in the outer margin, and bluish-green in the inner margin; the reverse of the lunar halo.* This difference in the arrangement of colors is owing to a difference in the position of the refracting crystals relative to the eye; in one case, posterior to the pupil; in the other, external to the eye.

"Sodic chloride + urea forms shining rhombic prisms" (Landois and Sterling, Text-book on Physiology, 2d Am. ed.,

* The transposition of colors in the halo is very strong evidence that the cause of the halo in glaucoma is to be looked for posterior to the iris, in accordance with the disposition of rays of light passing through the aperture of the screen.

p. 432). Acid sodic urate appears as a brick-red deposit, more rarely gray or white, in rheumatic or febrile conditions. Microscopically, it is completely amorphous, consisting of granules, which sometimes have spines on them. The potash salt is the same. They are easily soluble in warm water" (*vide supra*, p. 435). As the menstruum cools they are precipitated. When the urates in the blood are in excess (uric-acidæmia) the same influences which determine their presence in the synovial fluid of the joints, and their precipitation upon the serous surfaces, operate in the eye, which is more exposed to vicissitudes of temperature. Hence, variation in glaucoma halo with variation of urates in the blood might clearly occur without present change of intra-ocular tension. The glaucoma halo *might* "depend upon irritation of the retina and optic nerve," not caused by simple hyperæmia, but by precipitated urates; or it may be due to the presence in the aqueous, or vitreous humor, of urates in the shape of rhombic prisms, or amorphous granules (with or without spines) with power to cause diffraction of light. The prisms formed by sodic chloride + urea, at least, have this faculty.

A CLINICAL AND MICROSCOPICAL STUDY OF TWO CASES OF GLAUCOMA ASSOCIATED WITH INTRA-OCULAR HEMORRHAGES.

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In the early spring of 1890, through the courtesy of Dr. Isaac Barton, of Philadelphia, S. T. C., aged sixty-two years, of New York city, was seen for the first time. The patient, a cultured and well-informed man, though with all the physical appearances of chronic alcoholic abuse and excess, stated that during the previous summer he had had a sudden, though temporary, attack of dimness in the right eye, as if he "saw